Clothes Washer Life Cycle Cost (LCC) Spreadsheet Instructions

What does the Life-Cycle Cost (LCC) spreadsheet do?

The LCC spreadsheet (**currently LccCW_10.xls**) performs calculations for life-cycle cost and payback periods. The LCC spreadsheet operates in Excel 97 or Excel 7 (Windows 95). The Excel add-on Crystal Ball (version 4.0) allows the user to perform uncertainty analysis on key input variables.

What are the Worksheets in the Workbook?

The workbook **LccCW_10.xls** includes the following worksheets:

LCC (Sample Calc)	contains the input selections and a summary table of energy use, operating costs, LCC and Payback.
LCC (Distributions)	contains the input selections as in the LCC (Sample Calc) sheet. The energy, cost, LCC and payback data are for the current sample if Crystal Ball is running or the last sample run if not currently running.
Water Price Dist	contains price and escalation data for water.
Household Data	contains marginal energy prices for each sample household, washer cycles per year for each household, and fuel use distributions.
Engineering	contains the manufacturer costs for each efficiency level, as well as the manufacturer and retail markups.
Energy Price	contains energy prices from the various sources of energy price information; this is used for determining the energy price escalation.
drate dist	contains data from which an average discount rate and a distribution of discount rates is determined.
Lifetime	contains the retirement function for clothes washers and the average clothes washer lifetime in years.

Setup	this is used as an interface between user inputs and the rest of the worksheets -- do not modify this sheet.

How does the user operate the spreadsheet?

To execute the spreadsheets fully you will need both Microsoft Excel and Crystal Ball software. Both applications are commercially available. Crystal ball is available at http://www.decisioneering.com.

1. Once you have downloaded the LCC file from the Web, open the file using Excel. At the bottom, click on the tab for sheet **LCC (Sample Calc)** or **LCC (Distributions)**.

2. Use Excel's commands at the top **View/Zoom** to change the size of the display to make it fit your monitor. Note, that the zoom level for each of the worksheets should be set to the same value. Otherwise a bug in Excel will cause a 'Not enough system resources to display completely' error.

3. The user interacts with the spreadsheet by clicking choices or entering data using the graphical interface that comes with the spreadsheet. Choices can be selected from the box labeled **List Inputs** on either of two work sheets:

   a) **LCC (Sample Calc)** or,
   b) **LCC (Distributions**).

   A change in either input sheet also changes the other. In the box titled **List Inputs** select choices from the selection boxes for (1) energy price projection, (2) start year, (3) baseline design, (4) standard case design, (5) water heater (WH) / dryer combination, (6) water escalation rate, (7) manufacturer's cost (percentile or distribution).

   On the LCC (Distributions) worksheet, discount rate can also be entered if a value other than the default distribution is wanted. After any changes, restore this value to =drate_dist if you wish to restore the default distributions.

   On the LCC (Sample Calc) worksheet, non-default values can be specified for the discount rate, clothes washer lifetime, cycles (wash loads) per year and energy prices. Click on the Restore Defaults command button if you want to restore the default values for these parameters in this worksheet.

4. To change assumptions on **List Inputs** click on the assumption you wish to change, and click on the new assumption from the menu.

5. This spreadsheet gives the user two methods of running the spreadsheet.

   a) If the LCC (Sample Calc) sheet is chosen, then all calculations are performed for single input values, usually an average. The new results are shown on the same sheet as soon as the new values are entered.

   b) Alternately, if the LCC (distributions) sheet is used. The spreadsheet generates results that are distributions. Some of the inputs are also distributions. The results on the LCC distribution that are shown as single values only refer to the results from the last Monte Carlo sample and are therefore not meaningful. To run the distribution version of the spreadsheet the Excel add-in software called Crystal Ball must be enabled.

What is the *LCC (Sample Calculation)* sheet used for?

LCC difference and Payback are in the LCC (Sample Calc) sheet are based on single point values. This page can be used to see the effect of changing a single parameter. It is also used to determine a rebuttable presumption payback (when inputs are based on test procedure values wherever possible).

How does the user run the Crystal Ball simulation? (LCC Distribution sheet)

To produce sensitivity results using Crystal Ball, you need simply select ***Run*** from the **Run** menu (on the menu bar). To make basic changes in the run sequence, including altering the number of trials, select *run preferences* from the Run menu. After each simulation run, the user needs to select *Reset* (also from the **Run** menu) before *Run* can be selected again. Once Crystal Ball has completed its run sequence it will produce a series of distributions. Using the menu bars on the distribution results it is possible to obtain further statistical information. The time taken to complete a run sequence can be reduced by minimizing the Crystal Ball window in Excel.

A step by step summary of the procedure, for running a distribution analysis, is outlined below:

1. Find the Crystal Ball toolbar
2. Click on *RUN*
3. Select *Preference* and choose from the following choices:
   a) *Monte Carlo*[1]

[1]Because of the nature of the program, there is some variation in results due to random sampling when Monte Carlo or Latin Hypercube sampling is used. We recommend using Latin Hypercube.

b) *Latin Hypercube*
c) Initial seed choices and whether you want it to be constant between runs
d) Select number of Monte Carlo **Trials** (we suggest 10,000 for high accuracy calculations and 500 for quick calculations).

4. To run the simulation, follow the following sequence (on the Crystal Ball toolbar)
   RUN
   RESET
   RUN

5. Now wait until the program informs you that the simulation is completed.

What kind of output does Crystal Ball generate?

1. After the simulation has finished Monte Carlo run, to see the distribution charts generated, click on the Windows tab bar that is labeled *Crystal Ball*.

2. Currently, the life-cycle cost savings and payback periods are defined as **forecast** cells. The *frequency* charts display the results of the simulations, or trials, performed by Crystal Ball. Click on any chart to bring it into view. The charts show the low and high endpoints of the forecasts. The **View** selection on the CB toolbar can be used to specify whether you want cumulative or frequency plots shown.

3. To calculate the probability of LCC savings being positive, either type 0 in the box by the right arrow, or move the arrow key with the cursor to 0 on the scale. The value in the **Certainty** box shows the likelihood that the LCC difference between the baseline and standard case will be positive. To calculate the certainty of payback period being below a certain number of years, choose that value as the high endpoint.

4. To generate a printout report, select **Create Report** from the **Run** menu. The toolbar choice of **Forecast Windows** allows you to select the charts and statistics you are interested in. For further information on Crystal Ball outputs, please refer to *Understanding the Forecast Chart* in the Crystal Ball manual.